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Memorandum 6M-4208

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Division 6 - Lincoln Laboratory
Massachusetts Institute of Technology
Lexington 73, Massachusetts

SUBJECT: BIWEEKLY REPORT FOR PERIOD ENDING 24 FEBRUARY 1956
To: Jay W. Forrester
From: Division 6 Staff
Date: 1 March 1956
Approved: JCP/jic
J.C. Proctor

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SAGE OPERATIONAL PLANNING

(Group 61, D. R. Israel)

DIRECTION CENTER (J. Ishihara)

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Surveillance (E. Wolf)

The rough draft of the "Guide to Adaptation Requirements for the Air Surveillance Functions of the SAGE System" has been completed. Memoranda 6M-4075 (2nd draft), "Operational Performance Requirements for SAGE System Telephone Data Circuits," and 6M-4150 (draft), "Mathematical Specification for SAGE System Coordinate Transformation of Crosstold Data," have been issued.

WVI - XD-1 Crosstell (S. J. Hauser)

The sequence control program by D. Latimer has been checked out. The following programs have been written and are awaiting checkout:

Manual intervention and dynamic register display (Kresge)
Light-gun action storage makeup (Latimer)
Switch read-in storage makeup (Latimer)
Geography display (Bryan)

The following programs are in various stages of preparation:

Radar inputs and tracking (Brooks)
Switch interpretation (Kresge, Dimock, Hauser)
Radar history display (Dimock)
Track history display (Duffy)
Track situation display (Benson)

Identification, Manual Inputs, XD-1 Weather (S. Hauser)

Correction 2 to 6M-3780-1, "Operational Specifications for the Identification Function in SAGE," has been written and will be reviewed before publication which is expected within the next biweekly period.

Correction 1 to 6M-4028, "Mathematical Specifications for the Identification Function in SAGE," reflects the same revisions for the math specs as correction 2 does for the OPS specs.

A report on the use of IBM model 047 in ESS and a rough draft of operational specifications for ESS weather are in preparation. Both should be completed within the next biweekly period.

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DATA SIMULATION AND REDUCTION (W. S. Attridge)

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Data Reduction (R. Olsen)

The first rough draft of the operational specification for data reduction has been completed. Design of the data reduction program is now in process. The general structure of the program has been decided and some detail as to the output is defined.

Simulated Data Generation (J. Levenson)

Program Design: While all details of the SDG program have not been decided, the basic interactions of subprograms have been defined and a first estimate of tables is nearing completion.

Coding: The basic subroutines used in the SDG program are coded in symbolic notation and ready for checkout. Coding of the more difficult mathematical equations has begun.

Operational Specifications: In the process of detailed flow diagramming of the program, necessary limits have been set which restrict or modify the operational specifications. These have been documented and will be distributed soon, together with minor corrections and modifications to 6M-4067.

The card formats for all inputs have been decided upon. With Ray Newhall's cooperation, forms are being designed for use in specifying inputs. As soon as the final forms are ready they will be distributed.

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ESS DC IMPLEMENTATION AND COORDINATION

(Group 62, J. A. O'Brien)

EXTERNAL EQUIPMENT AND COMMUNICATIONS (I. Aronson)

Wire Communications (F. Irish, C. Carter, W. Glass)

A conference was held at NET&T on 20 February to discuss recording control circuits and the installation of the G/A radio TCAP.

A meeting was held at Lincoln on 23 February with representatives of the Traffic Department of AT&T to discuss operating practices for the SAGE console telephone key units.

A second draft of 6M-4157, "Test Concept for SAGE G/A Voice-Radio Subsystem," has been published and distributed. Memoranda 6M-4145, "Telephone Director for the SAGE Experimental Subsector," and 6M-4146, "General Description of Telephone Facilities in the Display and Auxiliary Consoles," have been published.

Memoranda 6M-4169 through 6M-4197, giving the operating instructions for the various console telephone key units, have been published.

PROGRAMMING (R. P. Mayer)

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EPSCOM

The EPSCOM personnel are now concentrated at Murphy Army Hospital, room 134B, extension 109. EPSCOM also maintains an outpost at Lincoln, room B-118, extension 5531. Sam Thompson, Jim Mazza, Ron Mayer (part time), secretarial service, and a small transient work area can be found there.

Three programmers have been added to EPSCOM: Anne Tebbetts and Margaret Tefft of BTL and Joseph Palermo of WE. William Holden is on loan to MTC for a few weeks. These four bring the present EPSCOM force to 30 people, although Arnold Werlin is now working part time with the GFI test team, and some of the WE programmers are about due to leave EPSCOM.

EPSCOM Utility Programs (C. S. Sherrerd)

Certain experimental work in the field of utility programs for use by EPSCOM members and some of the equipment test teams is nearing completion, with only a few minutes of computer work left to be done. This effort has resulted in a reel of digital tape containing approximately two dozen programs, of which some are central computer and input equipment diagnostics, some are special modifications of

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PROGRAMMING (continued)

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the utility programs such as the loading, punch, print, trace, and assembly programs, and some are programs produced by EPSCOM programmers themselves. A special system has been developed whereby any of these programs can be brought into core and/or drum memory from the tape simply by pressing the "load from drums" button. A short program previously loaded onto AM drum #02 then determines which program is desired by examining certain push-button settings and proceeds to read that program in from the tape accordingly. This system will, of course, be superseded by R. L. Carmichael's master utility control program system, but its simplicity and immediate availability should render it useful until the MUCP system is completely developed. This system is chiefly the result of the efforts of EPSCOM programmers, Margaret Dolan and Chris Sherrerd.

EPSCOM Tracking Programs (C. S. Sherrerd)

The remaining major errors in the existing ESS single-track tracking program have at last been discovered and corrected. The faulty use of the "DIM" instruction in two places accounted for the main difficulties.

The rewrite and modification of this program for use with external equipment subsystem acceptance tests in SAGE production subsectors is progressing. The scheduled completion date of 15 March will probably not be met, but it is felt that the final coding and card punching should be completed by then. Core memory allocations have been specified, flow diagrams of the over-all program and of certain detailed portions have been drawn, and the over-all coding specifications have been written. At present, five EPSCOM personnel are involved in this effort: Nancy Mardirosian, Margaret Dolan, and Chris Sherrerd of BTL, and Charles Kellogg and Wayne Gramling of WE. However, Margaret Dolan and Wayne Gramling will soon begin work on other programming efforts and will be replaced on the tracking program team by Anne Tebbetts and Margaret Tefft, both of BTL.

Finalization and documentation of the existing tracking program is also requiring a great deal of effort. The instruction card deck is being brought up to date, and a final printed copy of the program, reproduced in reduced size by the Xerox process, is yet to be obtained.

The ambiguity concerning identification numbers for the various forms of the tracking program has been clarified. The existing tracking program which is now available only for use with all gap-filler and the South Truro long-range radar input data of ESS carries the title ETRX0100. This number replaces the original EPSCOM catalog number ETRX0300. The tracking program versions currently being written will have the following program numbers:

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PROGRAMMING (continued)

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8500	General tracking program for use in ESS
8550	General tracking program for use in SAGE
8900	Tracking program for LR and GF radar equipment subsystem acceptance testing in ESS
8950	Same as above except for SAGE
8700	Tracking program for height finding equipment subsystem acceptance testing in ESS
8750	Same as above except for SAGE

Card preparation room job numbers corresponding to each of these seven program numbers have not yet been assigned.

EPSCOM Height-Finder Programs

Final checkout of height-finder test program No. 8102 has continued. On Wednesday, 15 February, an error-free test (program-wise) was conducted with the South Truro height finder site. It was the opinion of T. Sandy that program No. 8102 is operating correctly and supplying the requirements of the height-finder acceptance test specifications. The program will be cleaned up and documented.

J. J. Maroney and Chris Sherrerd (BTL), coauthors of the tracking program, have considered some of the requirements of the height-finder test program No. 8200 (flight test). Work will start immediately on this program. (J. J. Maroney)

The height-finder test printout routine has apparently been completed to the satisfaction of the test team, and should be rough-drafted during the next biweekly period. (G. Cox, F. Sweeney)

EPSCOM Crosstell Program (K. Brock)

Lou Rose and I have been debugging the crosstell master-slave program. We have run it several times and found several errors. The program should be completed in the next two or three week.

EPSCOM G/A Generation Program (R. Bernards)

James Wong and I have compiled, recompiled and started to debug the G/A program along with the editor input subroutine.

EPSCOM G/A Message Display (J. R. Jubb)

Bill Vollmer and I have written a program to display the ground-to-air message. The program reads the OB drum, selects the G/A messages, sorts them according to burst number, forms the messages into a display and presents them on the situation display console.

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PROGRAMMING (continued)

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The program will be checked out next week and should be debugged by 2 March 1956.

CIRCUIT SUPPORT (R. J. Callahan)

Centralized Probe System (W. F. Santelmann, A. J. Hingston)

The design of the 227-foot passive probe has been completed. It provides a 100:1 ratio with a rise time of 13 msec and transient error of about 2% peak when used with a Tektronix 541/545 scope. The input impedance has been measured as 9.1 megohm shunted by 29.6 pf. The equalizing components, six capacitors, six resistors, and one inductor, are located in a small box at the probe end of the cable.

In the course of equalizing this probe, serious distortions of 10% to 20% amplitude due to magnetic coupling between turns of coax wound on a spool were observed. Experiments indicate that the effect is erratic and that a minimum spacing of 1 to 2 inches between turns will eliminate stray coupling.

A 55-foot passive probe system has been designed for MTC. It provides a 50:1 ratio with a rise time of 13 msec, and an input impedance of 10.2 megohm shunted by 16.2 pf. Sixteen such cables are being installed in MTC.

It is interesting to note that all coax cable lengths from 2-1/2 feet to 227 feet require the same internal damping resistance (approximately 650 ohms total).

The two 227-foot probe systems (the passive and the 6197-follower types) are now ready for installation in XD-1.

Charactron Vector Intensity Decoder (R. B. Paddock)

There is still difficulty in meeting all the operating specifications while staying within the tube limits of an XD-1 pluggable unit.

SD Recording Camera (L. Sutro)

The following memoranda are intended to answer the obvious questions about the use of the SD recording camera and explain its theory of operation. The first memo has been issued. The second awaits more test and illustrations. The third is being typed.

6M-4168 Film Negatives and Prints for XD-1
Cameras

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CIRCUIT SUPPORT (continued)

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- 6M-4163 Operation of SD Recording Camera, AN/FSQ-7 (XD-1, XD-2)
- 6M-4207 Standard Operating Procedure for Lincoln Lab Technicians Handling Film for SD Recording Camera

DESIGN CONTROL (J. D. Crane)

Input and Output Converters for XD-1
Test Pattern Generation

In XD-1, an input converter is needed to change the output of the pattern generator to a signal which is compatible with the LRI, GFI, and XT inputs. These same converters are also applicable to the conversion required to permit the use of BTL-type DDR's in XD-1. Output converters are needed to allow XD-1 signals to be fed to BTL-type DDT's in a compatible fashion. A means of accomplishing these conversions has been agreed upon.

Acceptance Test Plans, AN/FSQ-7

Acceptance test plans for the AN/FSQ-7 (DC-1) in the test cell were submitted by IBM for comments. The philosophy and intent of this document were satisfactory and it received concurrence. (R. Gerhardt)

CER81, to modify the output specifications to enable a 100-wpm teletype output, has been returned to the auto file. It will come up again 1 May. There is not enough data to evaluate at this time.

CER's 42 and 94, regarding the normal area assignment switch, are awaiting action from IBM.

CER108, regarding the area discriminator, is being coordinated.

Operational specifications, 6M-3989 and 6M-3774, and mathematical specification 6M-3953 were received for TIR release. (S. Ginsburg)

I visited BTL at Whippany to investigate several aspects of the AN/FSQ-7, Data Coordinate sets. Several problems have yet to be resolved before an adequate 750-output section can be specified. In particular, a phone-line transmission system must be established between the output section and a receiver. (F. R. Durgin)

A study of the SAGE system message formats, drum bit layouts, and site labels for XD-1 has been undertaken in order to compile into one document all correct existing formats. (J. Giordano)

Arrangements with IBM, Group 22, and Group 62 personnel for establishing a Raydist system in ESS has been initiated.

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POWER (J. J. Gano)

XD-1 Power System

Because Piantoni has left the Laboratory, the major responsibility for debugging has reverted to DeSart of IBM. Jim Leavitt will act as liaison and will be responsible for the completion of Lincoln tasks. Biweekly Lincoln-IBM meetings will be held to review progress.

D-C Supplies

Coffin is investigating the performance requirements for d-c voltages supplying transmitter test circuits. He is trying to determine whether a transistor feedback system or a constant voltage transformer and rectifier should be used.

Magnetic Amplifiers Control Circuits (G. F. Sandy)

A study is being made of the power controls in XD-1 to determine if the present control relays can be replaced by magnetic amplifiers used in logic-type circuits. It appears that the cost will be less for a magnetic amplifier system than the present relay system. It is hoped that the magnetic amplifier system will also prove more reliable because of the passive nature of the required components.

Building 10

The responsibility of maintaining the laboratory power has been transferred to Jim Lynch of the Barta Building.

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ADVANCE DEVELOPMENT

(Group 63, D. R. Brown)

MAGNETIC MATERIALS (J. B. Goodenough)

Memory Core Testing

The total number of memory cores double-tested by this section to date for the 256 x 256 x 37 memory is 2,468,985. There are also about 60,000 untested and 20,000 single tested cores on hand, making an approximate grand total of 2,550,000 cores. In addition 101,200 cores returned from Koch have been retested. (R.Zopatti)

Chemistry

Analysis: Considerable effort has again been directed toward the solution of several problems in chemical analysis. An accurate method for the determination of Li is still sought. The determination of small amounts of nickel, cobalt, and iron can probably be accomplished with the use of the spectrophotometer. Several methods are being tested to complete the analysis of memory core compositions.

Refiring: In order to successfully refire memory cores in air, a temperature almost as high as the original firing temperature is required. This is equivalent to the quenching process used in some other laboratories. A crystallographic criterion of a good memory core has been found to be a unit-cell edge equal to 8.422 Å.

Experimental Ferrite: F-397 toroids have been made from several lithium-nickel ferrite compositions. The effects of various firing conditions are under investigation. (D. Wickham)

Physics

Apparatus: The stabilization of the vibration amplitude of the vibrating coil magnetometer is required for high sensitivity. An analysis of this problem is now under way with a study of the amplitude and phase response of the vibrator as a function of frequency. The design of the required compensating networks is being based on the results of this study. (D.O. Smith and N. Menyuk)

A transistor-regulated power supply has been constructed for use in the d-c fluxmeter. It is designed to hold the filament voltages in the amplifiers constant within 0.1 per cent. Further testing is required to ascertain the long-term stability and transient response. (R.A. Pacl, Jr.)

Experiments: Measurements of the magnetization vs. temperature

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have been carried out from liquid nitrogen to 200°C on a powder sample of 50-50 zinc germanium ferrite. A single measurement at the liquid helium temperature was also taken.
(D.O. Smith and N. Menyuk)

Theory: Further calculations of the effect of a transverse field on the dynamics of spin rotation indicate that the increased rate of spin rotation is not necessarily translated into increased domain wall velocity. This leads to considerable ambiguity in the physical interpretation of this effect. It is apparent that the wall thickness in the dynamic case must vary markedly from the static wall thickness. (N. Menyuk)

TRANSISTORS (D. J. Eckl)

Life Tests

Parameters have been measured for the life test transistors and the worst change is an increase in I_{e0} of about 1.3 μ a after 7000 hours.

The shielded shift register has been running for 6321 hours since its last error. The unshielded register has operated 2014 hours since malfunctioning. The TM-1 type register has now operated 960 hours since its last malfunction.

To check the effect of high temperatures, ten General Electric 4JDL1A17 transistors have been stored at 100°C and β and I_{e0} have been measured daily. After 264 hours, changes have been slight.

Transistor Circuits Course for Technicians

A course on transistor circuits is being given once a week by C.T. Kirk for Division 6 technicians engaged in circuit and component testing. This is intended to prepare them to service and construct the transistorized equipment now appearing in increasing numbers in the laboratory.

MEMORY (J. L. Mitchell)

Cooling and Supplies

The installation of the power supplies is proceeding satisfactorily. Regulated a-c filament voltage will be available for the 3-bay rack next week. The electrical wiring for the air conditioning is proceeding satisfactorily and should be complete in a week. One Westinghouse compressor has been received by the contractor and the other was to have been shipped the week of February 20th. This means we should be able to have the air conditioning running by April 1st.

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256² Construction

To date, 181 memory plane modules have been accepted. Four 256² memory planes have been assembled and inspected. The two-shift operation of the memory plane testing has increased the output so that we should have the twenty 256² planes available on April 1st.

The switch-driver input amplifiers have been checked out and installed in the 3-bay rack. The installation of the switch-drivers is awaiting the arrival of the 5998 tubes from Tung Sol. The modification of EMAR control is about complete.

Advance Development

The layout of the transistor sense amplifier circuit is under way. Some experiments are being run in an attempt to improve the transformer time constant in the sensing amplifier.

An investigation is under way to determine the maximum operating speed of ferrite cores in various environments.

A 4 x 4 printed plane using "pegs" has been successfully assembled, soldered and tested in MFS VI. Experiments on methods for producing printed planes by plating processes have been producing encouraging results.

DISPLAY (C. L. Corderman)

Development

A modified Charactron tube was tested during this period which had the electron-optical system of a 5" tube in a 19" envelope. Without post-acceleration, the character size was about 0.100" and with the normal A₃ voltage of 9KV, this size was reduced to 0.060". Further evaluation of the distortion from the second focus coil and with yoke deflection is in progress. Group 65 is presently constructing a similar tube using a color dot mask for post-acceleration rather than the dag helix. This will enable an overall voltage of 12 - 15 KV. without the large reduction in character size. A study of the resolution loss and distortions introduced in this tube will indicate the possibilities for future work on developing finer dot masks.

The installation of display cables from MTC to B-034 is proceeding on schedule. The console should be ready to operate again about the middle of March.

XD-1 Tests (J. Kriensky, H.E. Zieinan)

A new jig for adjusting the magnetic deflection compensation controls has been completed by I.B.M. and operates very successfully.

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The test rack for supplying magnetic deflection compensation signals has been modified to provide diagonal deflection as well as independent vertical and horizontal deflection. These new signals showed considerable interaction between the two axes, so initial adjustment is now made using the diagonal deflection with the vertical and horizontal deflection signals providing a fast means of getting an approximate setting of the controls.

After adjustments are completed with the rack, some trimming is necessary with the standard test pattern. By using an optical comparator for this final trimming, an adjustment can be reached which is satisfactory under all conditions.

When the deflection system is not completely adjusted some noise is evident which is not caused by the deflection system. Although this noise seems to be contributed by many sources, two sources were especially pronounced.

The most pronounced of these sources was the Digital Display System. When this system was turned off the noise was reduced considerably. Attempts are now being made to determine the specific cause of the crosstalk.

The second source of noise was present when the four consoles in the TBS room were turned off. This would indicate some irregularity in the dummy loads or ringing on the lines to these consoles. Attempts are being made to isolate this irregularity.

We have tried to measure the load presented to the display analog line drivers. These measurements must be made while power is off in building F and are hampered by the limited time on Sundays when this condition is available. When the readings are completed, they will have to be modified to take into account the fact that all consoles were presenting dummy loads instead of actual loads. To make this calculation, readings are being taken to determine both the dummy loads and actual loads presented by the consoles.

Of the load readings actually completed, some have indicated an unaccountable impedance to ground. Since the consoles had power off at the time, it is possible that the four consoles showing irregular dummy loads in the previously mentioned noise tests may account for these impedances to ground. More readings are being taken.

Legibility Studies (R.H. Gould)

The Charactron legibility tests in the TBS room in Building F have not been started because the needed punched cards and test equipment are not yet ready.

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A problem of intensity measurement arises because the quasi-static measurement with a spot photometer that was used in the experimental lighting room involved a display cycle that the XD-1 display system cannot imitate. The spot photometer as it has too slow a response for a dynamic measurement of character intensity. It seems possible, however, that by using the optics and electronics of the spot photometer with a faster external indicator we will be able to make direct measurements of the brightness of a displayed character. The Charactron under test in Building F can then be adjusted to the same intensity as the one used in the experimental lighting room.

SYSTEM DESIGN (K.H. Olsen)

TX-O Computer

All 1400 logic plug-in units have been delivered and the plug-in flip-flops are being constructed. The console has been screwed to the floor and is ready to be wired. The racks should be assembled during the next biweekly period.

TX-O Flip-Flop

We are pleased with the margins on the final TX-O flip-flop. Trigger amplitude is almost constant to 10 megacycles. The supply voltages can be varied better than plus and minus 50% and the margins decrease little between 0° and 80° centigrade.

LOGICAL DESIGN (W.A. Clark)

Basic read-in and octal constant conversion programs have been written by Phil Peterson and should enable TX-O to handle programs prepared on Flexowriter tape very shortly after startup. A note on the instructions and operation of the computer is being prepared.

Jim Forgie has completed that part of the speech input equipment for Whirlwind which is to be used at the Acoustics Lab to obtain recordings of filtered speech sounds together with the necessary timing and synchronizing signals to permit proper identification of the spectra by the computer. One more panel of equipment must be completed before the over-all system can be tested.

SPECIAL STUDIES SECTION (T. Meisling)

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CFAR

A memo describing a proposed engineering design of a constant-false-alarm-rate (CFAR) computer, suggested by Division 4, is now being prepared by R.L. Best and T. Meisling.

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ESS TEST PLANNING - WWI MTC OPERATION

(Group 64, E.S. Rich)

WWI COMPUTER OPERATION (L.L. Holmes)

Scheduled Computer Hours	329.0
Interrupting Incidents	9
Hours Lost	1.7
Percent Good Time	99.5
Mean Time Between Failures in Hours	36.4

The computer reliability has been very good. Defective tubes were responsible for the majority of the lost time. Each of the tube failures was of the type that is not found with marginal checking.

G. E. G/A Data Link Testing

Several additional subsystem tests of the WWI G.E. G/A data link have been made under the supervision of C. S. Lin. The tests used a simple computer program that loaded the WWI output system with test messages. These test messages were automatically transmitted to Prospect Hill via telephone wire then via radio to a mock-up monitor at Lexington. Earlier tests revealed that equipment believed to be the DDR at Prospect Hill was causing random bits to appear on the Lexington mock-up. After this difficulty was overcome, two more tests were conducted and occasional errors still appeared at the mock-up. In the last of these two tests, an Ampex recording of the WWI output was made and later played back to Lexington. Errors observed during the live test did not recur. This indicated that these errors were probably not originated at WWI. As an aid in locating troubles in future tests, a closed-loop, self-checking routine, scheduled for use on 5 March, is being written by E.W. Pughe, Jr., for the present subsystem test program.

The output system equipment is being daily marginal checked with a program prepared by L. D. Healy. It is planned to redistribute the marginal checking circuits for the data link output system on the installation day of 5 March.

Raytheon Magnetic Tape System

Facilities have been made available for locking unit #1 in the read mode. When the unit is locked in read, a "one" is stored in digit 3 of the intervention register whose address is si 303. The lock-in-read circuits for units #2 and #3 have been modified to correct a logical error.

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L. H. Norcott, having completed the above assignments, will soon begin a study, to be completed by 30 March, of the existing maintenance procedures for the magnetic tape system. When the study has been completed, it is hoped that plans can be outlined that will include not only improved periodic checks but also a method to daily marginal check the equipment.

Central Computer Marginal Checking Program

Don Morrison has made considerable progress with the rewriting of the program. When completed, the control routine for the program will be similar to that of the Room 156 equipment check program. Art Curtiss and Don Morrison will rewrite those equipment check program that require it. All contemplated changes to the program should be completed by 20 April.

48 KVA Motor-Generator Set

The new M-G set was placed in service on 18 February. It replaced the 600 A unit that furnished tube heater power in the central computer area. The replaced unit is in need of a major overhaul and it will be retained for emergency service.

MEMORY TEST COMPUTER (W. A. Hosier)

Control

Checkout of the new control is proceeding approximately on schedule. The only serious hitch to date has been a longer rise time than expected in certain power cathode followers which was circumvented by logical changes involving small additional delays in resetting the "sequence switch". The control is now operating on about half the old instructions, both from Panel Memory and Core Memory; hopefully all the instructions will be operating by Monday, 27 February. The balance of that week will then be devoted to fine adjustment of these instructions (pulse termination, etc.) and to getting the new instructions (sof variations, cb, pf), which affect drum and tape, into operation. Thus, as mentioned in the MTC memorandum of February 23, the computer ought to be available to prospective users at 1:00 PM Monday, 5 March, except for magnetic tape, which probably will not be fully operating for at least a week after that date.

It is not expected that operation will be 100% normal during the first month after March 5. This month will be a period of "shakedown" for the new installations, and will require more than the normal maintenance time, besides in all likelihood producing more machine errors during assigned operating time.

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As is also mentioned in the February 23 memo, programmers are referred to Art Hughes's Correction No. 1 to the MTC Programmer's Manual, 6M-2527-2. In addition, the paper tape preparation formerly done here under Ray Newhall is being transferred, for the present at least, to the Barta Building tape room under Marian Callaghan.

Magnetic Tape

Just about all the essential parts of the tape equipment have been received from IBM; power and cooling air are tied into the tape adapter frame, and actual pulse testing of the frame has commenced. Next week should see some test writing on tapes under manual control, and the following week preliminary trials under computer control should be possible.

Charactron Facility

The building electricians have nearly completed the pulling of some 85 coax cables from MTC to the experimental display room B-030. When these have all been connected and the ch instruction made operative again, the display console formerly in the computer room can be driven by MTC as it was before but in its new remote location.

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VACUUM TUBES

(Group 65, P. Youtz)

TUBE TECHNIQUES (J. S. Palermo)

Electron-Optics Studies

The program to redesign the Charactron in order to increase current density at the screen has been started. Preliminary examination of the CBS Colortron bulb to be used in this study and the tube specifications indicate most of the bulb processing techniques must be modified before the first tube is produced. The panel and funnel sections of the bulb must be processed separately so that the curved aperture mask may be assembled into the bulb before the two sections are welded together. The progress to date is satisfactory.

Bariated-Nickel Cathode Program

The first bariated-nickel tubes to investigate the effect of pressure variations in the fabrication of the cathode and H_2Zr activator to beam uniformity are presently on life test. An up-to-date summary report of the bariated-nickel program is scheduled for 1 March 1956.

Electroluminescent Studies

Six additional particle size cuts of CdS were submitted to Group 24 for further studies in electroluminescent storage devices. In addition to these samples, a number of 0.150 diameter glass beads were coated with a conductive film of SnO_2 for storage cell application.

RECEIVER TUBES (S. Twicken)

Data analysis is continuing on the gate pentode dimensional analysis program. It has been found that the maximum of the i_p-e_{c1} transfer curve is quite dependent upon the relative position of the suppressor grid between the screen grid and plate.

Final changes to the draft of the type O528 MIL specification (RETMA #6414) have been agreed upon; the proposal will be submitted to ASES by G.E. next week.

At the request of Eisele of IBM, Corderman and I have discussed with them difficulties in the radar-mapper consoles due to arcing in the CRT. I have taken several of the offending tubes for detailed analysis.

CHARACTRONS AND TYPOTRONS (P. C. Tandy)

Seven MIT 19" tubes have completed between 0 and 8950 hours of life test, and eight Charactrons have completed between 1593 and 2348

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CHARACTRONS AND TYPOTRONS (continued)

hours. Charactron #551 is operating at pulse zero-bias because it fails to give 50- μ a pulse-matrix current at the 20% duty cycle life test condition, but gives more than 50 μ a (about 80 μ a) during the transfer characteristic test which has a duty cycle less than 1%. The eight Charactrons did not show appreciable leakage or ion current at the last testing period. Three new MIT tubes have been given preliminary tests and are in the process of being put on life test.

The pulse transfer-characteristic test machine was found to give inconsistent results. A program was undertaken by D. V. Mach to study and modify the equipment. Future results should be more consistent and tubes with cutoff voltages as great as 150 volts may now be tested.

Ten oxide-coated cathode study tubes have completed between 508 and 6664 hours. They continue to deteriorate with life, but none have failed since the last report. Tubes which comply with memorandum 6M-3965 and cutoff voltages less than 150 volts will be started on life test in the near future.

Thirty-three bariated-nickel cathode tubes are on life test with up to 3000 hours of operation. Life test data is available.

Eighteen Typotrons are continuing on test. Data has been taken on these tubes, but there is some question as to testing method. A report will be issued when the data has been analyzed.

COMMERCIAL TUBES (T. F. Clough)

Electron-Optics Studies

Six Colortron bulbs were dissected at the metal flange weld so that the face panels and funnels would be available for phosphor deposition and aluminizing studies. An anode button was successfully put on a panel section. So far, all of the phosphor and aluminizing studies are progressing satisfactorily. The only remaining problems are mounting the Colortron mask and welding the panel and funnel together at the metal flange.

Ferromagnetic Evaporated Film

One of the evaporation units of Group 65 was successfully redesigned and rebuilt to permit R-F heating of metal in a crucible. This unit was used by D. O. Smith and F. S. Maddocks of Group 63 to make one trial run for their ferromagnetic evaporated film studies. The crucible available for that run cracked during the evaporation. However, they obtained films for study and analysis. New crucibles will be obtained and more runs made next week.

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SAGE CC AND DC SITES

(Group 66, B. E. Morriss)

EQUIPMENT (W. H. Ayer)

Cooling

Lincoln Laboratory, Western Electric, and IBM conferred at Western Electric last November to discuss and define their responsibilities for the air conditioning design of the SAGE system building. In general, it was agreed that Lincoln would furnish recommendations for the system design philosophy, such as duplexing, growth, and flexibility. Consequently, the cooling memorandum, which was re-written and released on 24 February 1956, concerned itself with the cooling system needed to insure compatibility with the AN/FSQ-7 electronic equipment. The memorandum presents growth and flexibility recommendations which will allow the cooling system to continue to serve the electronic equipment over its expected life. It also recommends that a standard environment for all electronic components of 55° F. to 77° F. dry bulb temperature and a maximum relative humidity of 50% be maintained.

Orifice Testing Program

Francis Associates were retained last year by Lincoln Laboratory to conduct studies on vacuum tube cooling methods. Specifically, they were to determine if any changes to the rubber orifices that direct the cooling air over the tubes in AN/FSQ-7 and XD-1 should be considered in the light of present knowledge and experience.

The orifice tests were conducted in the Building F air plenum on a mock-up test unit. To obtain the necessary data to maximize the efficiency of the orifices, four different orifices were tested for each of the three tube types (5998, 5965, 2420) under investigation. For each of these orifices, runs were made at four or five power settings and the static pressure drop across the orifice was plotted against the maximum hot spot tube temperature. From these curves and recorder information, representative composite curves were plotted to illustrate the orifice test report.

A draft copy of the report is now being reviewed to determine how the information realized from the test program can be used.

Conversion Equipment for XD-1

This equipment is comprised of a number of IBM machines which have been modified for use in program preparation for XD-1 and performs three basic functions:

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EQUIPMENT (continued)

1. Conversion of data from IBM cards to magnetic tape
2. Conversion from magnetic tape to IBM cards
3. Conversion from magnetic tape to a high-speed printer

This equipment has all been received, but some difficulties have been encountered in having it provided as Government-furnished property. This type of IBM equipment is not included on the Government list of IBM equipment which can be rented. It thus appears that the conversion equipment for XD-1 can be provided only by negotiation of separate contract, rather than the normal channels used for rental of IBM equipment by the Government.

LRI Monitors

IBM has received a Contract Change Notice authorizing them to implement ECP #12 which calls for the provision of three prototype LRI monitors for XD-1. In addition, they were authorized to commence work on all of the equipment defined in Amendment 5 to Exhibit AFCRC 1A describing XD-1. The amendment requires that an entire LRI equipment group be provided for XD-1. This means that an LRI monitor frame and any rework necessary to make the consoles conform to XD-1 specifications must be furnished at a later date. In addition, this amendment covers certain modifications to console equipment required for the incorporation of the Kelvin and Hughes large board display equipment in Building F.

PLANNING OF SITE ACTIVITY (A. J. Roberts)

Site Planning

A preliminary study has been made of the jobs necessary for the support of the SAGE site activities. A report, "Draft of Plan for Site Activity," has been circulated to interested Lincoln personnel for comments. It includes:

1. A broad-brush description of the SAGE tasks
2. Manpower requirements in chart form
3. A detailed description of the SAGE tasks to support the manpower estimates.

A series of meetings with other Lincoln groups is scheduled for the week of 27 February to discuss and revise the report. The revised plan should be ready for distribution on 7 March. It will be necessary to coordinate our planning with that of outside organizations and to get agreement on responsibility for the jobs which have been described.

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PLANNING OF SITE ACTIVITY (continued)

Test Planning

A Lincoln-BTL meeting was held on 23 February to discuss the height-finder test specification. Agreement was reached that the test concept memos should include a plan for obtaining performance margins on the subsystems. The plan should outline the points in the subsystem at which margins should be taken; essentially these are at the inputs and outputs of the various components. The test specifications will be revised to include tests for obtaining these performance margins.

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PROGRAM PRODUCTION

(Group 67, J. A. Arnow)

CENTRAL PROGRAMS (A. R. Shoolman)

Table design procedures and bookkeeping are being formalized. Betty Kollett has been assigned to assist in this effort. Communication tag pool information, phased with program checkout schedules, will be first available on 27 February. Central bookkeeping program coding is under way; coding of central track monitoring will begin 27 February.

Coding of the card input program is completed and the program will be checked and released to the card room early in the next biweekly period. Preliminary coding specifications for the output message makeup portion of the height priority program have been prepared. Work has continued on an OMR describing changes in the operational specifications for crosstelling in the initial program, and preliminary coding specifications for the crosstell programs are now in preparation. Work is continuing on the initial startover program and a part of the preliminary coding specification has been prepared. Barbara Ackley has studied the organization of the DCA program and in-out transfer requirements and is considering program length, storage requirements, and other problems affecting dynamic allocation of computer core storage.

Preliminary Sectional Drafts for the following display programs have been written: Air movements data and warning crosstell situation displays, and miscellaneous digital displays. Specification of antiaircraft, weapons directors' and antiaircraft directors' attention devices, and air movements data histories will be completed in the next biweekly period. Warning crosstell display coding is partially complete. Investigation of the geography digital display program and a digital display central program has begun.

The initiation, radar mapping, and air surveillance officer's switch interpretation programs have been coded, and will be released to the card room next week. The coding of monitoring and manual inputs supervisor's switch interpretation programs will be completed in the next biweekly period.

Preliminary Sectional Drafts for the interception and weapons direction switch interpretation programs will be issued in the next biweekly period.

OPERATIONAL PROGRAMS (D. L. Bailey)

Tracking Programs (J. P. Haverty)

The coding of all tracking programs is essentially complete and

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OPERATIONAL PROGRAMS (continued)

several are ready to be released to the card room. Parameter check-out will begin early in March.

Bill Hoppe and Ardeth Miller have joined the subsection. They will help to replace Bill Walsh (leaving 1 March) and to augment the tracking effort.

Weapons Direction Programs (J. C. Leavy)

With the addition of the intercept direction math spec to the IPS list, we are now able to proceed full force on the interception and weapons assignment programs.

Miscellaneous Operational Programs (F. E. Ogg)

The first operational program, raid forming, was handed over to the card room to be key punched and compilation should start next week. Two other programs, track sort and height priority, will be ready to go to the card room shortly.

It has been decided that Simulation II (data association) will be omitted from the initial ESS program.

Robert Gardner has joined the nontracking operational program section and will work on the simulated tape input program.

CHECKOUT AND UTILITY PROGRAMS (P. R. Vance)

Utility Programs (C. H. Gaudette)

A master utility tape which contains the utility control, read-in, compiler, and checker programs has been recorded, checked out, and is being used during most of our assigned time. This tape provides a utility system which operates with binary and instruction cards, but does not operate with a library tape (the library tape contains files of compiled programs). The programs which maintain and use the library tape are now being added to this system.

Operator Training (P. Bagley, J. Thompson)

An informal course has been held for one week to train computer operators in the use of the new system of utility programs. The operators learned to read the flow diagrams which detail the operating procedures step by step and were able to have a small amount of practice at the computer with the preliminary versions of the master tape.

Utility System Documentation (P. Bagley, A. M. Hills)

Documents equivalent to operational specifications have been prepared

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CHECKOUT AND UTILITY PROGRAMS (continued)

for all the utility programs written so far, and for the tables, tape forms, and card forms used in common by the utility programs. A document describing the programs and facilities available in the new utility system is in preparation.

Through the programming bulletins, every attempt is being made to announce changes in the utility system and to warn of possible pitfalls in the use of the system.

CARD PREPARATION AND COMPUTER OPERATION (H. Newhall)

XD-1 Computer Time (J. I. McGovern)

Program Checkout	92:55
Downtime	9:10
Returned to IBM	<u>11:56</u>
Total Assigned Time	<u>114:01</u>

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ADMINISTRATION AND SERVICES

(Group 60, J. C. Proctor)

PERSONNEL

Staff

Following are the changes in staff personnel:

Terminations

James D. Childress
Lois M. Pearson
Geno L. Piantoni

Transfers

Russell C. Collmer from Group 61 to Group 62

Nonstaff (W.A. Kates)

Following are the changes in nonstaff personnel:

New

Barbara Higgins	Office	Group 61
Theophilos Kuliopulos	Student	Group 65

Transfers

Eleanor Albanese	Office	Group 64 to 62
John Q. Johnson	Technician	Group 64 to 63
Genevieve Tetreault	Office	Group 60 to 63

Terminations

Joan Le Blanc	Office	Group 61
Barbara Ritchie	Office	Group 61

GENERAL ENGINEERING (A.R. Smith)

Partition D-232

Two separate plans have been arrived at; one of wood fabrication, the other a combination of wood and metal. The wood fabrication design will begin this week. Further investigation is required for the wood-metal design. The combination design has the decided advantage of being readily modified to an all-metal fabrication which provides maximum fireproofing characteristics.

Core Test Handler

In view of the mounting problems resulting from the dimensional decrease in core size and the desirability of a quick change core

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test handler from 50-30 to memory core size, all attempts to modify previously designed equipment has been abandoned for a new concept. To expedite the program, design and fabrication are operating concurrently. This new concept apparently has a single, yet familiar problem; that of singling out an individual core and successfully transmitting it to the test area. A breadboard technique is near completion which is believed to be the solution.

TEST EQUIPMENT HEADQUARTERS (L. Sutro)

Tony Kyricos, a technician who has been with us since Test Equipment Hqs. was organized in 1952, is transferring to the magnetic core testing section of Group 63. Tony is known for his willing help to those with test equipment trouble and his initials "A.K.," that appear above the test date on scopes throughout the division. Simeon Thompson, who has been testing and trouble-shooting test equipment, plug-in units and other parts of Whirlwind, will be Tony's replacement.

TEST EQUIPMENT COMMITTEE (L. Sutro)

Present committee membership:

D.R. Brown, Chairman
L. Sutro, Executive Secretary

The following group representatives:

H.W. Hodgdon	Group 60
R.L. Best	Group 63
K.H. Olsen	Group 63
C.S. Lin	Group 64 (WVI)
E.K. Gates	Group 64 (MTC)
T.F. Clough	Group 65 (Lex.)
S. Twicken	Group 65 (Barta)
A.M. Bille	Test Equipment Maintenance

The scope of the committee's work now includes technical guidance of the Components Evaluation laboratory in Group 60. Accordingly, half of each committee meeting is devoted to component problems. At the meeting of 24 February (see 6M-4220), H.W. Hodgdon described the organization of the laboratory, its equipment and its two assignments, failure analysis and evaluation testing. The committee approved purchase of seven units of commercial test equipment including:

One Millivac 17C VTVM for J. Fadiman, Group 63.

Two Donner Oscillators, 2cps to 2 mcps, for 48-hour loans.

The committee further approved a change in the circuit of the six-channel pulse amplifier Mod. I. It approved transfer out of

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the division of nine 193 scopes and approved 6M-4219, "48-Hour Loans of Division 6 Test Equipment."

DOCUMENT ROOM (A.M. Falcione)

Return of Secret Material

All secret documents may now be returned to the Division 6 Document Room on "Receipt For Classified Material" forms.

Destruction of IBM Classified Documents

Permission has been received from IBM to destroy IBM classified documents. This will eliminate the necessity of returning them to IBM.

Central Cataloguing System for Division 6

It is expected that Division 6 will soon have a Staff member librarian who will be responsible for establishing a subject indexing system for Division 6 memoranda, reports, etc. This should greatly facilitate the retrieval of existing information.

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STUDIES IN PROCESS

GROUP 62

Circuit Support

Remote Equipment Maintenance

R. Paddock, W. Marston

Power

TX-0

J. D. Clarke

Thermistors for filament cycling

G. F. Sandy

WWI Refrigeration memo

R. F. Jahn

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(P. E. Falcione)

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3899-1	J. Levenson S. Hauser	Operational Specification for Training & Battle Simulation in the Sage System	C
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3982	J. J. Cahill	Mathematical Specifications for Antiaircraft Direction in the Sage System	C
4013 C#1	H. Gochman	Mathematical Specifications for Track Detection & Initiation in the Sage System	C
4067	J. Levenson	Operational Specifications for Simulated Data Generation	C
4077	J. Levenson R. Russo S. Hauser	Mathematical Specifications for Training & Battle Simulation in the Sage System	C
4086	E. L. Lafferty	Mathematical Specifications for the Recording Function in ESS	C
4096	S. F. Tower J. P. May	Height-Finder Request Word Problems	C
4144	B. Strauss	Modification of Operational Specification to Delete the Capability of Weapons Assign- ment & Intercept Direction Against Raids, Per Se	C
4156	S. Ornstein J. Ishihara	Initial Program Specification: Operational Specification for Crossteling in the Sage System	C

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4145	W. O. Glass	Telephone Directory for the Sage Experimental Subsector	C
4146	W. O. Glass	General Description of Telephone Facilities in the Display and Auxiliary Consoles	U
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4082-1	R. F. Reiss	Initial Program Specifications List	U
4128	J. P. Haverty G. S. Hempstead	Initial Program Specification: A Guide to Direction Center Operation	C
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<u>6M-</u>	<u>AUTHOR</u>	<u>TITLE</u>	<u>CLS.</u>
5304	E. D. Lundberg	ESS-PCC Approval of Proposal On ESS Utilization of Manual Height Finders	C
5309	E. D. Lundberg	ESS-PCC Status Report for Week Ending 10 February 1956	U
5310	E. D. Lundberg	ESS-PCC Status Report for Week Ending 17 February 1956	U

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